Whole Building Energy Performance Rating: ENERGY STAR Approach to Building Benchmark Development

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ENERGY STAR Goals

- Help businesses protect the environment through superior energy efficiency

- Motivate organizations to develop a strategic approach to energy management

- Convey information about energy performance in a simple metric that can be understood by all levels of the organization

ENERGY STAR Rating

- Monitor actual as-billed energy data
- Create a whole building indicator
  - Capture the interactions of building systems not individual equipment efficiency
  - Track energy use accounting for climatic and operational changes over time
- Give a peer group comparison
  - Compare a building's energy performance to its peer group
  - Describe how changes at a building level alter the building's standing relative to its peer group

ENERGY STAR Rating – Steps in Development

- Analyze national survey data
  - Commercial Building Energy Consumption Survey (CBECS)
- Develop regression models to predict energy use for specific space types
- Create scoring lookup table
  - Energy efficiency is defined by the residual difference between actual and predicted energy consumption
  - Scores are based on the distribution of energy efficiency in commercial buildings
  - One point on the ENERGY STAR scale represents one percentile of buildings
- Buildings that perform in the 75th percentile or better can earn the ENERGY STAR label

ENERGY STAR Rating

- **Statistically representative sample of the commercial building population**

- **Adequate measures of building functions NOT explanatory factors**

  - Functional Indicators = characteristics that define *what* the building does on a daily basis
    - Examples: square feet, degree days, hours
  - Explanatory Indicators = characteristics that impact *how* or *why* a building operates the way it does
    - Examples: specific HVAC technology, price

ENERGY STAR Rating

- Space types:
  - Offices, K-12 Schools, Dormitories, Warehouses, Medical Offices, Hospitals, Supermarkets, Hotels
- Ratable spaces account for over 50% of the commercial building market
- Allow for secondary space types:
  - Computer Data Centers, Parking Garages, Swimming Pools, Ambulatory Surgical Centers
- To date, over 26,000 buildings have used the tool to benchmark and track energy use

Current Limitations for Mission Critical Facilities

- Currently there is no rating capability specific to Mission Critical Facilities
- Computer Data Centers
  - Not an individual ratable space
  - Designated portion of building for data storage and computer equipment, common to many facilities
  - Because we cannot predict this energy use, we try to exclude it
  - Ideally have separate fuel meter
  - Otherwise, energy use is estimated according to floor area (~200 W/ft^2 gross floor area power density)
  - Limited to 10% of the total building floor area

Current Limitations for Mission Critical Facilities

- Prevalence in system
  - 3,806 benchmarked buildings with Computer Data Centers
- A *rating* for mission critical facilities would greatly enhance the tool
  - Could rate mission critical facilities as unique space types
  - Could better account for computer data centers within other space types

→ *This is why we are here – to ask for your help*

Possibilities to Enhance Tools for Mission Critical Facilities

- **General revisions to all ratings**
- **New data available – CBECS 2003**
  - ◆ # PCs, # Servers, % floor area devoted to computers, presence of server farm, presence of mainframe computer, presence of computer training rooms and public/student computer centers
  - ◆ Ability to enter "Data Center" as a main business activity

Possibilities to Enhance Tools for Mission Critical Facilities

- Must define: what is a data center?
  - Centralized location where computer processing occurs
  - Stand alone facility or portion of a building
  - Includes continuous computer processing, tracking, and memory storage for a wide variety of businesses
- To create an ENERGY STAR rating – must identify a discrete group of data centers that can be compared with each other
  - Are they common enough to form one group?
  - Are there a few identifiable categories?

Possibilities to Enhance Tools for Mission Critical Facilities

- **Ratable data center space type**
  - ◆ What are the key performance indicators for these models?
    - Processor power?
    - Memory or storage space?
    - Gross floor area cooled?
  - ◆ Each coefficient should represent the average response of the peer group

$$Energy\ Use = C_o + C_1 Area + C_2 Op.Hrs + C_3 HDD + C_4 CDD + C_5 Processor\ Power + C_6 Memory + ...?$$

Next Steps

- Identify key functional performance indicators NOT explanatory factors
  - Functional Indicators = characteristics that define *what* the building does on a daily basis
    - Examples: calculations per second, memory, W/ft² heat generated
  - Explanatory Indicators = characteristics that impact *how* or *why* a building operates the way it does
    - Examples: configuration of server room, brand of equipment

Next Steps

- **If new variables in CBECS are not adequate**
  - Short term possibility – Engineered model
  - Long term possibility – Work with Department of Energy for 2007 survey
    - Request over sampling
    - Request specific questions
- **Both options require a firm understanding of suitable performance indicators for mission critical facilities**

Summary

- ENERGY STAR rating system analyzes whole building energy performance
- Models require national survey data
- Models are based on functional performance indicators
- ENERGY STAR is in the process of updating its existing models
- ENERGY STAR hopes to incorporate more accurately servers, computer data centers, and other mission critical facilities
- Want to incorporate mission critical centers in a way that encourages energy efficiency
- Must identify key functional performance measures and compare this with available data in CBECS 2003

Questions for Discussion

- If energy use varies by data center type, what are the main categories that can be grouped?
- What are key drivers of energy consumption for mission critical facility equipment?
- How can we express these key drivers of in terms of functional performance indicators?
- Is it possible to measure actual use of equipment distinct from its design intent?

We want your input

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